



## MULTI-POINT SEAT BELT

### CROSS REFERENCE TO RELATED APPLICATIONS

This is a divisional continuation-in-part application of the US-serial number 09/554,463  
5 related to an international application number PCT/DE98/03270 (WO 99/24294, European  
Patent EP 1 037 773 B1, German Patent DE 197 49 780 C2) filed Nov. 10, 1998.

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention:

10 It is an object of the present invention to adapt a belt-feeding device to the seat-design and,  
while preserving user-friendliness, to ensure the restraint of every passenger of a transport  
system and to lower all acceleration-dependent forces imposed on them in order to enhance  
the survival chance in the event of any accident (front-, side-, rear-end collision and/or  
rollover or pile up/mass collision) or during in-flight turbulence.

15 ~~It is an object of the present invention to ensure the restraint of a passenger in order to~~  
~~enhance the survival chance associated with lowering all acceleration-dependant forces~~  
~~—in the event of any accident (front-, side-, rear-end collision and/or rollover or pile up/mass-~~  
~~collision) of a transport system (a motor vehicle, a train or an aeroplane) or~~  
~~—during turbulence-related vibrations of an aeroplane.~~

#### 2. Discussion of the Prior Art:

It is known in the prior art to provide for a passenger of a transport system

- a three-point seat belt (safety belt or lap-shoulder seat belt assembly), mounted in the  
motor vehicle, consisting of a shoulder belt extending across ~~the his~~ upper ~~body-part~~ of his  
body and of a lap belt extending across ~~the his~~ lower ~~body-part~~ of his body; or
- 25 – a two-point seat belt, mounted in the aeroplane, acting as a lap belt extending across ~~the his~~  
lower ~~body-part~~ of his body; or
- a suspender- (waist-) belt consisting of several pieces (belt-members).

30 In order to formulate in single terminology a generalized definition is presented for the  
proper term:

**Definition:**

**Proper Term:**

"Transport system"

Motor vehicle or train or ship or aeroplane

"Stiff first transport-system member"

Floor 6 of the transport system adjacent to a first seat-side SR (Fig. 1) or seat-cushion frame at the first seat-side or mid-tunnel (not drawn) of the motor vehicle adjacent to the first seat-side.

"Stiff second transport-system member"

Floor 6 of the transport system adjacent to a second seat-side SL or seat-cushion frame at the second seat-side or post section 91 (Fig. 13) of the motor vehicle adjacent to the second seat-side or side rail of the motor vehicle adjacent to the second seat-side

"Stiff third transport-system member"

Floor 6 of the transport system adjacent to the first seat-side or seat-backrest frame of the seat at the first seat-side.

"Stiff fourth transport-system member"

Floor 6 of the transport system adjacent to the second seat-side or seat-backrest frame at the second seat-side or post section adjacent to the second seat-side.

"Shoulder-belt deflector"

Belt deflector 5, 5b or D-ring 12 (Fig. 1)

It is well known to provide different restraint systems in vehicles, predominantly, three-point seat belts in various types for seats, ~~exemplified by DE 37 41 831 A1 shown in Fig. 11.~~

Evidently, when both shoulders of a passenger, conventionally belted, are not restrained in the event of an arbitrary collision with another vehicle in any direction, shown in Figs. 3, 4 and 7, the unrestrained shoulder can always move and/or rotate freely, thereby resulting in severe/fatal injuries in real-world accidents when

- the head crashes into the steering wheel and/or window pane and/or
- the airbag crushes the head, which, loaded by the forces related to pitch-acceleration  $\ddot{U}_H$ , yaw-acceleration  $\ddot{O}$ , longitudinal and/or lateral acceleration, is in "oop" (out of position).

Moreover, by the definition of „submarining“ the belted passenger submarines (slips downward) under his seat belt thus negating the protective effect of the seat belt.

It is well known to provide two-point or lap seat belts for aeroplane seats as well as mid-portion of the rear seats of motor vehicles. This lap seat belt is far less effective than a three-point seat belt. Due to very large accelerations during a turbulence-related flight the protective effect is very low.

5 A substantially improved protection is proposed by two different configurations of a one-piece seat belt, exemplified by DE 26 02 875 A1 (Figs. 8 to 10). An „X-shaped” restraint is arranged by extending both shoulder belts crosswise over the upper ~~body-part-of-body~~ while the lower ~~body-part-of-body~~ is restrained by the lap belt. Each end of the one-piece seat belt is connected to a belt retractor, fastened in the seat backrest. Two grab rings, positioned to the  
10 headrest, move along the belt. A single or double „X-shaped” configuration is defined by pulling a pair of grab rings and belt portions over the head, shoulders and head rest and engaging them in the corresponding hooks. Due to such intricate operation the seat belt remains unused.

DE-OS 23 45 847 is directed to a height-adjustable upper belt deflector of a shoulder belt portion of three-point seat belt, for adapting it to the height of the restrained shoulder of the  
15 passenger by means of a device, moved by a knob along the rails of the belt deflector. The overall stylish impression, spoiled by the belt deflector, rails and device with the knob, all mounted to the seat backrest, is not beneficial to sales. Moreover, a passenger, sitting on a seat juxtaposed to the seat, equipped with the belt deflector, device and knob, is  
20 severely/fatally injured when his head crashes therein.

According to the Claim No 2 of DE-OS 28 13 888 a four-point seat belt for a back-seated passenger, defined by the shoulder and lap belt portion of a three-point seat belt and an upper shoulder belt, is made of a one piece. Both belts are guided by two belt deflectors, adjacent to the lower part of the body of the passenger, and fastened to the vehicle frame. The end portion  
25 of the shoulder belt portion and the upper shoulder belt, both are provided with belt retractors, attached to the seat backrest. In an attempt to step out the passenger has to lower down the upper part of his body in order to slip underneath the upper shoulder belt which can never be removed.

In order to enhance the convenience the belt deflector of the upper shoulder belt is replaced  
30 with a latch plate and a corresponding buckle assembly, fastened to the vehicle frame.

DE 196 29 878 A1 teaches a four-point seat belt, comprising two independent three-point seat belts, each having a belt retractor, latch plate, belt deflector and buckle assembly.

US 3,977,696 discloses a four-point seat belt, comprising, a three-point seat belt and an upper shoulder belt, both, provided with belt retractors, are guided in two rails and driven by electrical motors of a heavy device. When the vehicle roof is totally deformed in a rollover-accident the heavy device crushes the passenger into instant death.

US 5,123,673 discloses a four-point seat belt, comprising a three-point seat belt and an upper shoulder belt, both provided with belt retractors. An automatic release device, which is intricate, facilitates a release of both buckle assemblies, each equipped with an actuator to release, regardless of which one is first manually released. When a MB 200 crashes into the vehicle door of MB S in the city of Geisenheim, a lateral intrusion is measured about 80 cm. In case of the installation the buckle assembly, actuator and other parts, all of which facing the totally deformed vehicle door, are destroyed. Hence, the other one is out of function. The severely injured driver remains restrained.

A complicated latch-plate-feeding device, installed to the side of seat cushion, moves forwards to present the latch plate of the three-point seat belt to the passenger, after having taken seat.

US 5,411,319 discloses a four-point seat belt, comprising two independent three-point seat belts, having a common lap belt portion. Two end belt portions of both three-point seat belts are projected through the seat backrest and attached to a pair of belt retractors, provided with a pair of supporting pieces, arranged in a pair of seat rails, retained thereby and movable therealong with the seat when longitudinally adjusted.

According to the above-mentioned patent docs US 3,977,696, US 5,123,673, US 5,411,319, ~~DE-OS 23 45 847, DE-OS 28 13 888 and DE 196 29 878 A1~~ the restraint system comprises a three-point seat belt, a second shoulder belt and two belt retractors, responsible for retracting both belts. The „X-shaped” configuration, formed by extending both belts crosswise over the upper body part of the body, has the following drawbacks in the event of an accident:

**D1.** Both belts are retracted to different length by two independently operating belt retractors within milliseconds.

**D2.** Under the load of the same belt force in a front collision the deformation of seat backrest, wherein both belt ends are fastened, is larger, thus increasing the forward motion.

Furthermore, it is impossible to attach an energy absorber because all four belt ends are occupied.

**D3.** Exemplified in US 5,123,673, the belt user has to depress two release buttons to release the respective main latch plates 9 from the main buckle assemblies. This two-click operation causes discomfort and hinders rescue work. See countermeasures by means of a single master release button, mentioned below.

A one-piece seat belt 1 (Fig. 1) ref. to DE-OS 28 13 888 is equipped with two belt retractors (not drawn), fastened to both belt ends in the seat backrest, and a belt deflector 17, anchored to the seat-cushion frame 3.3 of the mid-portion of rear seat. The feature, proposed for a child, has the following drawbacks:

**D34.** When the release button 84 is depressed, the first shoulder belt portion 1.1 gets entangled around the neck of passenger. For the operation of restraining and extending both belt portions into the „X-shaped” configuration, the passenger must lower his head first.

**D45.** Because all belt ends are occupied, it is impossible to attach energy absorbers and to adjust the belt to the size of an upper ~~body-part-of-body~~ 95 of an adult.

Generally, a child-seat is fastened by four auxiliary belts to the seat. Despite the „X-shaped” configuration of a one-piece seat belt to restrain a child, sitting in a child-seat, ref. to FR 2 342 872 A1 the problems, associated with the retraction of four auxiliary belts, submarining and energy absorption, remain unsolved in an accident.

Till now, trains, school buses and buses are not provided with restraint systems.

## SUMMARY OF THE INVENTION

Accordingly, the principle object of the present invention is to provide for passengers of a transport system seat belts, each equipped with a belt retractor, solely responsible for retraction, blocking and tightening or for protraction, a lower belt deflector to loosely guide a belt portion and multi-attachment points (multi-points of restraint), and to restrains a every passenger in multi-attachment points, in order to lower and distribute the acceleration-dependent loads, shown in Fig. 3 and Tables 1 to 3, to the multi-attachment points in the event of any accident ~~thereof or during in-flight turbulence-related vibrations of an aeroplane.~~

Nowadays, belt tighteners are incorporated into belt retractors, for example, of MB 500 SL in order to save costs, assembly time and space.

A second object of the present invention resides in an integration of a belt-feeding device in a seat, shown in Figs. 12a to 12f, in a user-friendly belt-feeding device to ease the restraint and serve as a protective-rollover device, shown in Fig. 17, as well as in comfort enhanced by one-click operation by means of a single master release button, which, when depressed, to-releases all latch plates from the buckle assemblies and/or returns the belt-feeding device to the home (resting) position. In emergency cases paramedics and fire-fighters can easily rescue the injured passengers.

A third object of the present invention resides in the conventional three-point seat belt associated with new parts, shown in Fig. 2, to serve as a transition product until multi-point seat belts are put into production, cost-, space-saving integration of the multi-point seat belt, equipped with energy absorbers, and the seat into a baby cot, child seat or safety seat, illustrated in Figs. 1, 23.

#### INDUSTRIAL APPLICABILITY

It should be apparent that the invention provides a substantially improved restraint, including the following features:

a) The survival chance is enhanced by the restraint of

- \* both shoulders and the torso, when the passenger is thrown forward (Fig. 4, Table 3) and/or subjected to the yaw  $\ddot{O}$ -acceleration-dependent torque  $T_{\delta}$ , and
- \* both thighs and the lower ~~body part of the body to prevent~~, when the passenger submarining (Figs. 14, 15).

~~e)b)~~ Because the belt retractor is attached to one belt end, a number of sets of vibration-dampening energy absorbers ref. to US serial no. 09/554,464 (WO 99/24292, (PCT/DE98/03271, European Patent EP 1 037 771 B1, German Patent DE 197 58 498 C2, CA pending US and CA patent 2,314,345) or German Patent DE 197 58 497 C2 can be attached to the other belt end (Figs. 112a to, 112bc, 18), thus gradually absorbing large impact energy below the respective injury-related values. The inventor of the present application has submitted those patent documents and applications to CIPO as well as USPTO. The vibration-dampening energy absorber consists of a number of clamping

elements, having sites of predetermined fracture, and a retaining element, which, fastened to the seat-backrest frame and/or seat-cushion frame, can serve as an integral part thereof.

d)c) Owing to the different positions of pairs of upper buckle assemblies, in plug-in connection with the respective belt-detachable latch plates 25 (Fig. 167), passengers of different body proportions can adjust the belts by themselves. Moreover, the seats, equipped therewith, can be modified to be used by adults or children, thus increasing the rate of seat occupancy in a bus, train or an aeroplane, exemplified in Fig. 2315.

b) In another embodiment an upper belt deflector 5b (Fig. 15), in plug-in connection with the buckle assembly 4, or the buckle assembly 4 is height-adjustable. Energy absorbers, above-mentioned, can be connected to this buckle assembly. Upon the use of the height-adjustable belt deflector 5b the height-adjustable D-ring 12, attached to the B-, C-, D-post section (pillar, pillar portion), shown in Fig. 1, or to the top edge of the seat backrest, is no longer needed. When the belt deflector 5b is not height-adjustable, it can be connected to energy absorbers which absorb energy and dampen vibration when the first shoulder belt portion moves it up.

e) In another embodiment the upper belt deflector 5a (Fig. 13) can be rigidly attached to the head rest 3.6a. Any adjustment of the height of the head rest 3.6a to the head automatically adjusts the height of the upper belt deflector to the shoulder. This feature differs from the D-ring ref. to DE 40 10 452 A1, which is in contact with the shoulder belt, when the passenger is thrown forward, and is moved up to intercept the head, when thrown backward.

g)d) In resting position the shoulder latch plate 2, in plug-in connection with an assisting buckle assembly 16, 16a, 16b, fastened to the seat cushion 3.1, B-, C-post section or seat backrest (Figs. 1, 2), is easily accessed by the passenger having the intention wanting to use the belt.

h)e) The seat belt can be equipped with a belt-feeding device, manually operated or by a drive apparatus, for example, hydraulic-piston cylinder unit, electrical motor (not drawn), which enhances the convenience and comfort of the user. This drive apparatus is switched on by a pressure sensor, built to the seat, or an existing switch such as lighting-, door- or touching switch. If the belt is not engaged within a dwell time, a control device is activated to switch off the drive apparatus and to reposition the belt-feeding device in the resting position.

i)f) For the convenience of the passenger, when stepping out, or for the quick-rescue of the injured passenger, ~~when being rescued~~ in accidents, the master release button **84** of the buckle assembly **9.1** is depressed to release all latch plates from the buckle assemblies and/or to return the belt-feeding device to the resting (home) position.

5 j)g) The round rollover tubes **20.2b** of the seat backrest frame **3.4d** are designed to guide the belt housing **20.4c**, **20.4d** (**Figs. 18, 19, 16, 17**), to act as safety bars in a rollover and to allow free view to the rear owing to openings **97R**, **97L** (**Fig. 23, 15**).

~~In another embodiment the seat belt can be connected to the seat in more than three attachment points (Figs. 1, 14, 23), in which both thighs (femurs) are restrained, thus protecting the passenger from submarining in a front, rear collision or rollover or when in sleeping position. Unlike the suspender (waist) belt, consisting of several belts, the portions of multi-point seat belt need not be adjusted in length, when the circumference of the passenger varies depending on the clothes worn.~~

#### BRIEF DESCRIPTION OF THE DRAWINGS

A number of embodiments, other advantages and features of the present invention will be described in the accompanying tables and drawings with reference to the xyz global coordinate system:

20 **Table 1** shows test data such as left / right thigh-force, belt force and pitch-angle of driver and co-driver in 50% offset crash test of several European vehicles at crash speed of 55 km/h.

**Table 2** shows yaw angle  $\phi$  of driver / co-driver in a 50% offset crash tests.

**Table 3** shows test data of the safest child-restraint system Chico Shuttle® at the converted velocity of 55 km/h in comparison with the safest vehicle among them listed in **Table 1**.

25 **Fig. 1** is a perspective view of a seat with buckle assemblies attached to the seat backrest and seat cushion as well as of the a 1st embodiment of a restraint system consisting of a multi-point seat belt **1**, shoulder-belt deflector 5, D-ring 12, latch plate **11** movable-moveable along the lap belt, shoulder latch plate **2** of belt end portion, in the direction of arrow „Z” in plug-in connection with an upper buckle assembly **4**, and a seat belt in X-shape, formed by crossing ~~both the first and second~~ shoulder belt portions **1.1**, **1.2**.

30 **Fig. 2** is a perspective view of a seat and of the a 2nd embodiment of a restraint system comprising three-point seat belt **1e** having a transition latch plate **2**, which will be inserted



into a transition buckle assembly 4e of a shoulder belt 1.11, pulled in the direction of arrow „Z”.

Fig. 3 illustrates load cases I, II and III in z-y plane in the event of a real-world accident.

Fig. 4 is a perspective view of a restrained dummy thrown forward in VW Polo® in a 50% offset crash test.

Fig. 5 illustrates a yaw-acceleration  $\ddot{O}$  and yaw-angle  $O$  of a vehicle about the vertical axis „z<sub>A</sub>” in a 50% offset crash test of two identical vehicles.

Fig. 6 illustrates a yaw angle  $O$  of vehicle about the vertical axis „z<sub>A</sub>” in a 50% offset crash test into a stiff barrier.

Fig. 7 illustrates four collision types „U1” to „U4” ref. to the research work of Institute of Vehicle Safety, a Dept. of German Insurers Association.

Fig. 8 is a front view of a seat belt ref. to DE-OS 26 02 875 in the home position.

Fig. 9 is a front view of a double X-shaped seat belt ref. to DE-OS 26 02 875.

Fig. 10 is a front view of a single X-shaped seat belt ref. to DE-OS 26 02 875.

~~Fig. 11 is a top view of a  $\angle$ -shaped seat belt ref. to DE 37 41 831 A1.~~

Fig. 12a is a schematic, perspective view of the 1st embodiment of a buckle assembly 4a, equipped with release cable 4.2.

Fig. 12b is a schematic, perspective view of the 2nd embodiment of a buckle assembly 4b, equipped with an electrical release-motor 4.2b.

Fig. 11c is a schematic, perspective view of a 3rd embodiment of a buckle assembly 4c, equipped with a release cable 4.3.

~~Fig. 13 is a perspective view of an upper belt deflector of the head rest.~~

~~Figs. 17a-12a to 17f-12f~~ are schematic, perspective views of a 1st embodiment of the a belt-feeding device 20 in kinematics from the resting position to the operating position.

~~Fig. 13 is a perspective view of an upper belt deflector of the head rest.~~ Fig. 163 is a schematic view of the 2nd and 3rd embodiment of spatially-adjusting belt-feeding devices 20a and 20b in kinematics from the operating position to the resting position in x-y plane.

Fig. 14 is a perspective view of a latch plate 11 of a lap belt portion 1.3 in plug-in connection with a buckle assembly 8 and of the 1st embodiment of a the belt-feeding device 20 of the seat belt.

Fig. ~~23~~15 is a front view of the seat **3a to 3d**, in which the restraint systems **1a to 1d** are integrated, for passengers of different weights and body proportions (sizes).

~~Fig. 15 is a perspective view of the 2nd embodiment of a spatially adjusting belt-feeding device 20a from the resting position to the operating position and of a height-adjustable belt deflector 5b.~~

~~Fig. 18-16 is a schematic, perspective view of a seat, equipped with the rollover tubes 20.2b, and of the a 4th embodiment of a belt-feeding device 20c.~~

~~Fig. 19-17 is a schematic, perspective view of a seat having the rollover tubes 20.2b, the a 5th embodiment of a belt-feeding device 20d, provided with a safety bracket 20.6, a height- and width-adjusting mechanism 27, 27a.~~

~~Fig. 20 is a cross-sectional view of the 1st embodiment of the height- and width-adjusting mechanism 27 along the line I-I of Fig. 19.~~

~~Fig. 21 is a cross-sectional view of the height- and width-adjusting mechanism 27 along the line II-II of Fig. 20.~~

~~Fig. 22 cross-sectional view of the 2nd embodiment of the height- and width-adjusting mechanism 27a along the line I-I of Fig. 19.~~

## DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

The advantages of the preferred embodiments in the Chap. "INDUSTRIAL APPLICABILITY" are outlined hereinafter with regard to the functions and features thereof.

The method of the present invention capitalizes on the premise that a seat belt is employed to restrain a passenger in at least four attachment points of the seat to distribute all acceleration dependant loads, particularly the yaw  $\ddot{O}$ -acceleration-dependent torque  $T_{\delta}$ , thereto in an accident, thus ensuring the operation of a single belt retractor to pre-tension (bias) as well as tension the belt, restraining both shoulders, upper- and lower ~~body part of the~~ body and lowering all the loads, in particular, in co-operation with the energy-absorption when a number of sets of vibration-dampening energy absorbers is put into use. This will be apparent when all forces, imposed on the belted passenger, shown in **Figs. 3 and 4**, are formulated in the event of a front collision, where the loads of the mass  $D_s$  of the torso are lowered because

- the forward motion „ $w_v$ ” is minimized, thus substantially reducing the pitch-acceleration  $\ddot{U}_H$  and force  $F_{Hy}$  of the mass  $D_H$  of the head, and
- the yaw-acceleration  $\ddot{O}$  is minimized, thus substantially reducing the torque  $T_\delta$ , imposed on the head. Great torque  $T_\delta$  is the most latent force, responsible for sudden death.

To a great extent massive head injuries can be avoided.

Load case I in z-y plane: The rotating mass  $D_S$  rotates about the rotating axis „S” at the pitch-angle  $U_S$  and mass  $D_H$  about the rotating axis „z” at the pitch-angle  $U_H$  in **Table 1**, thereby resulting in the pitch-accelerations  $\ddot{U}_S$ ,  $\ddot{U}_H$  and rotating forces  $F_{Sy}$ ,  $F_{Hy}$ . The addition of both rotating forces yields the force  $F_V$  linked to the forward motion  $w_v$  of passenger, shown in **Fig. 4**.

~~In front and/or rear collision the passenger is exposed to the submarining force  $S_y$ , shown in Fig. 14.~~

Load case II in x-y plane: The upper ~~body part~~ of body is subjected to the torque  $T_\delta$ , exerted by the yaw-acceleration  $\ddot{O}$  about the rotating axis „z”. When the upper ~~body part~~ is restrained in an X-shape, the torque is substituted by a pair of forces.

Load case III in x-z plane: The rotating mass  $D_S$  rotates about the rotating axis „S” at the rotating angle  $U_y$  and mass  $D_H$  about the rotating axis „z” at the rotating angle  $U_{Hy}$ , thereby resulting in the rotating accelerations  $\ddot{U}_y$ ,  $\ddot{U}_{Hy}$  and rotating forces  $D_{Sy}$ ,  $D_{Hy}$  (not drawn). In a rollover-accident the passenger is subjected to the load  $F_{Sz}$ .

Load case IV: In turbulence-related vibrations of an aeroplane the load  $D_{Sy}$  together with  $D_{Hy}$  takes the form of periodical load  $\pm F_{Hx}$ ,  $F_{Sz}$  of  $\pm F_{Sz}$ ,  $T_\delta$  of  $\pm T_\delta$ ,  $S_y$  of  $\pm S_y$  and  $F_{Sy}$  together with  $F_{Hy}$  of  $\pm F_V$ .

The restraint system, illustrated in **Fig. 1**, is provided with a conventional belt retractor **13** having a clamping device, housed in the B-, C-, D-post section or in the seat backrest 3.2 at one of both seat-sides SL and SR of a seat ~~backrest 3.2~~ and connected to the second belt end EL. The ~~other-first~~ belt end ER is provided with a shoulder latch plate **2**, which is retained, loosely guided by a lower belt deflector **17**, fastened to the vehicle floor, and inserted into one of the upper buckle assemblies **4, 4a to 4c, 14, 14a, 18, 18a, 18b**, arranged in or to the seat backrest **3.2**. In all embodiments an ~~additional~~ main latch plate **9** can move along the seat belt

1 between both belt ends EL and ER. When plug-in connecting the shoulder latch plate 2 (in the direction of arrow "Z") to the buckle assembly 4 and the main latch plate 9 to the main buckle assembly 9.1, an X-shaped restraint of the upper ~~body-part-of-body~~ and both shoulders as well as a restraint of the lower ~~body-part-of-body~~ are accomplished by the both-first and  
5 second shoulder belt portions 1.1, 1.2 and the lap belt portion 1.3.

In the 2nd embodiment, shown in Fig. 2, a transition product, comprising a conventional three-point seat belt 1e and new parts, has to be invented due to the delay in producing  
~~resulting from the production of multi-point seat belts 1.~~ The floor fitting (not shown) is replaced by the lower belt deflector 17. The first belt end of the lower first shoulder belt  
10 portion 1.11 is provided with transition latch plate 2. The first belt end of an upper first shoulder belt 1.12 and the ~~other-second belt~~ end are equipped with a transition buckle assembly 4e, having a transition release button 84c, and with a second belt retractor 13a, arranged in the seat backrest 3.2. Due to the second belt retractor the transition buckle  
assembly 4e, acting as the shoulder latch plate 2, 2a of multi-point seat belt, is located in a  
15 home position on a seat-backrest aperture of the seat at the first seat-side. Hence, the seat-  
design is not compromised. In a coupling position tThe restraint in an X-shape is defined by plug-in connection of transition latch plate 2 with the transition buckle assembly 4e, pulled out  
from the seat-backrest aperture, wherethrough a transition portion of the upper first shoulder  
belt is projected. This transition portion and the lower first shoulder belt portion 1.11 define  
20 the first shoulder belt portion 1.1. In order to resolve the above-mentioned drawback D1, the spring force of the second belt retractor 13a, to retract the upper first shoulder belt 1.12,  
released by en-depressing the transition release button 84c, is far less than that of the belt retractor 13. Although ~~Despite~~ the circumference of the restrained passenger varies, varying  
depending on the clothes worn, and the seating-position differs different seat position-the  
25 lower first shoulder belt portion 1.11 always projects through the lower belt deflector 17 at a sufficient length of "l<sub>1</sub>" ~~in-order-to~~ maintain the function of the belt retractor 13 to retract, to block the belt as well as to release the retracted belt during the journey travel and the function of the belt tightener (not drawn), incorporated in the belt retractor, to forcefully retract  
(withdraw) and tighten the belt in an accident. The transition release button 84c of transition  
30 buckle assembly 4e, arranged to or in the seat, can be controlled neither by release cable 4.2 nor by electrical release-motor 4.2b. ~~Hence, the release-button-84e-~~ It can only be activated by

electrical signals emitted from the master release button 84 when depressing the master release button 84.

The other second belt end of upper first shoulder belt 1.12 can be connected either to a coupling fitting 1.2a, 1.2b, 1.2c (Figs. 112a, to 112c, 18, 19) or to the second belt retractor 13a (belt retractor 13 shown in Fig. 18) having a coupling fitting 1.2b (Fig. 156) in order to receive a number of vibration-dampening energy absorbers to dissipate great impact energy and dampen strong vibration.

In another embodiment the upper first shoulder belt 1.12a consists of the transition buckle assembly 4e and a shoulder latch plate 2a (not shown), similar to latch plate 2 (Fig. 1), which is plug-in connected to

- the upper buckle assembly 4, 4a to 4c, 14, 14a, 18, 18a, 18b, 18.1 to 18.3, arranged in to the seat backrest, in operative position or
- the assisting buckle assembly 16, 16a, 16b in resting position.

When motor vehicles are already licensed, modification of different seats and three-point seat belts can easily be accomplished by arrangement of at least one buckle assembly, of the lower belt deflector 17, of the second belt retractor 13a and by a variety of one-piece, detachable, upper first shoulder belts 1.12a with different lengths. Furthermore, the latch plate 2a can be detached from the buckle assembly by depressing the master release button 84.

A first shoulder belt portion 1.1 is defined by the upper first shoulder belt 1.12, 1.12a and the lower first shoulder belt portion 1.11.

At With an expensive modification or at in new transport system the convenience and comfort are enhanced by the use of belt-feeding device 20, 20a to 20d enhances the convenience and comfort, where the upper first shoulder belt 1.12, 1.12a having with transition buckle assembly 4e is a part thereof the belt-feeding device.

Evidently Beyond doubt, the three-point seat belt 1e in plug-in connection with the upper first shoulder belt 1.12, 1.12a serves suited as a temporary transition solution for the multi-point seat belt 1, 1a to 1d during the production.

In the above-mentioned embodiments to resolve the above-mentioned drawback D34 the upper body part of body is restrained by extending the shoulder belt portions crosswise in an X-shape when the belt-feeding device 20, 20c, 20d positions the first shoulder belt portion 1.1, the belt end ER of which is arranged to or in the side SR of the seat backrest, from the

operative position to a resting position. These features e2) and e3) have the advantage that the common practise to operate the conventional three-point seat belt is preserved.

e1) when at least one latch plate 2 is plug-in connected to the buckle assembly of the seat backrest; ~~or~~

e2) when a latch plate 2, arranged to the end ER of the first shoulder belt portion 1.1 of a belt feeding device 20a, 20b, is plug-in connected to the buckle assembly of the seat backrest; ~~or~~

e3) when the belt feeding device 20, 20c, 20d positions the first shoulder belt portion 1.1, the belt end ER of which is arranged to or in the side SR of the seat backrest, from the operation position to a resting position.

These features e2) and e3) have the advantage that the common practise to operate the conventional three-point seat belt is preserved.

In order to resolve the above-mentioned drawbacks D2 and D45 great energy is absorbed and strong vibration is dampened by a large number of vibration-dampening energy absorbers connected to the respective upper buckle assemblies 4, 4a to 4c, 4e, 7, 8, 8a to 8d, 9.1, 14, 14a, 15, 15a, 18, 18a, 18b, 18.1 to 18.3, 19, 19a, 19b, 19.1 to 19.3 (Figs. 1, 154, 19, 23) into which latch plates are inserted plug-in connected.

As shown in Figs. 1 and 14, the seat belt 1 is equipped with an anti-submarining latch plate 11, which can be connected to one of the buckle assemblies 7, 8, 8a to 8d, arranged in or to the seat frame 3.3. When plug-in connected, the lap belt portion 1.3 is subdivided into two belt portions 1.3R, 1.3L. Owing to the restraint of both thighs the submarining problem in front or rear collision, in rollover or turbulence-related vibration of an aeroplane is resolved. Moreover, the passenger, lying in a sleeping position, is well protected.

Because the reel (spool) of the conventional belt retractor can accommodate only a limited length of belt, it is possible that the length of the seat belt for the sleeping position is insufficient. As exemplified in Fig. 1, a buckle assembly 8b, 8c is provided with a release button 84e and a length-adjustable belt, fastened to the seat frame, for the purpose of compensating the length of seat belt 1 between the sleeping and normal position.

A buckle assembly 8d, provided with a release button 84d, is attached to the front portion of the seat cushion.

Owing to the plug-in connection of the anti-submarining latch plate 11, 25 with one of the buckle assemblies a lady in a long gown as well as a child are well protected from submarining (Fig. 23).

The lower belt deflector 17 comprises a housing having an attachment hole to receive a pin 17.1. Both members can be made in one piece. If necessary, the pin 17.1 is surrounded by a sleeve 17.2 of plastics, having corrugation or knobs, which is a common part of the conventional D-ring 12. This D-ring 12 can be replaced by the lower belt deflector 17. The aperture of the belt deflector 17 to loosely guide the belt portion is dimensioned so as to such a size to retain the latch plate 2 in resting position, thus allowing the use as a three-point seat belt.

In the 1st embodiment ref. to Figs. 14, 172a, 172d the belt-feeding device 20 in resting position is provided with a device to countersink the belt-feeding plate 20.9 in the seat backrest to improve the overall impression of the seat-design, whereon the sales success depends.

When the passenger takes his seat, a drive apparatus, being activated,

- moves up over the head rest a contact portion of the belt-feeding plate 20.9, moveable in an opening of the seat backrest (Fig. 172a), out of the opening and then the guide tube 20.1 with the operating arm 20.2, whose belt ring 20.8 houses and loosely guides the first belt portion 1.1 (Fig. 172b);
- rotates the operating arm and the first shoulder belt portion over the head rest, his head and in front of the upper part of his body 95 at „ß” (Fig. 14), where in a contact position a key of the operating arm projects through a receptacle of the contact portion of the belt-feeding plate 20.9 or a clamping receptacle 20.11 of the belt-feeding plate 20.9a (Figs. 172c, e, f); and
- countersinks the contact portion of the belt-feeding plate 20.9 or 20.9a and the guide tube 20.1 with the operating arm 20.2 until reaching the operating-operative position in which the first shoulder belt portion extends across over the upper part of his body and the drive apparatus is switched off (Fig. 172d).

To prevent the entanglement of the first shoulder belt portion 1.1 behind the seat, particularly when positioned furthest forward, that first shoulder belt portion 1.1 in resting position is intercepted by the belt-catching member 20.7, 20.7a (Figs. 14, 172a, 172b). When

the second shoulder belt portion 1.2 and the extending belt portion 1.4 are arranged to the post section, both shoulder belt portions can also be intercepted by the belt-catching member.

When the seat 3c (Fig. 2315) has a high seat backrest, the curved guide tube 20.1 of belt-feeding devices 20ax (Fig. 15not drawn) can be modified in-to a straight-running operating arm 20.2 of the belt-feeding device 20 (Figs. 12a to 12f).

In the 2nd or 3rd embodiment the belt-feeding device 20a or 20b is provided with a height-adjustable belt housing 20.4a and radial-adjustable tube 20.3 (Figs. 15, 16). Both devices differ from each other by the position of the guide tubes 20.1 on the seat backrest. Each guide-tube can be driven by a drive apparatus, housed in the seat backrest. The guide tube 20.1 of the belt-feeding device 20a is pivotally attached in a stiff supporting tube 3.61 of the height-adjustable head-rest 3.6a.

The height of „Ah” of belt housing 20.4a, having a latch plate 2, plug-in connected to any buckle assembly 4, 14, 18, is adjustable when the passenger moves two openings, facing each other, along the operating arm 20.2a. Alternatively, the passenger can move a handle 5.2, such as locking handle 27.5 of the height and width-adjusting mechanism 27, 27a (Figs. 15, 19 to 22), to adjust the height of „Ah” of upper belt deflector 5b.

In order to ensure the operation of pro- and retracting any shoulder-belt portion, arranged in the seat backrest (Figs. 8 to 10), is loosely guided by a shoulder-belt deflector which, having a rectangular shape, is usually pressed in a seat-backrest aperture of the seat backrest on the top edge.

The belt-feeding devices 20a, 20b have to meet the following criteria:

- Passengers can freely get in and out of the vehicle compartment thanks to the distances of „a” and „b” between the post section 91 and operating arm 20.2a (Fig. 163) in resting position; and
- the device, when moved, does not interfere with the head rest 3.6a, height-adjustable about „Δh<sub>K</sub>”, and with the head of the passenger with/without hat 92.

Regarding the kinematics of the height-adjustable belt housing 20.4a with the latch plate 2 from the operating-operative position to the resting position, the trajectories of „Ba2” and „Bb” are well clear of the passenger's head not in the range of a hat thanks to a radial-adjustable tube 20.3 incorporated into the operating arm 20.2a. Without the radial-adjustable tube 20.3 the operating arm in the trajectory of „Ba1” would interferes with that hat.



In the 4th and 5th embodiment ref. to **Figs. 186, 197** the belt-feeding devices **20c, 20d** differ from each other by the rotatory movement of the operating arm **20.2**, whose guide tube **20.1** is pivotally attached to a bearing casing **20.10**. Preferably, upon the rotation about the head, the translatory and rotatory movement of belt are synchronised.

To form the upper part of the seat backrest frame **3.4d** a pair of angle fittings **26a**, a pair of rollover tubes **20.2b** and a pair of side girders **27.1a** or four tubes **27.1** (not drawn) are form- and/or force-locking connected to each other by connecting pins **26.2, 26.3** (drawn with dotted lines) and/or by welding, bolting, ~~glueing~~gluing and/or riveting. The belt housing **20.4c** or **20.4d**, having a moveable safety bracket **20.6**, is guided by rollover tubes **20.2b** and driven by an electrical motor **20.5** along the threaded spindle **20.1a**, fastened to both angle fittings **26a**, from the resting position (drawn with dotted lines) to the ~~operating~~operative position, and back again. In the ~~operating~~operative position the holes of the rollover tube **20.2b** and belt housing **20.4d** are aligned with each other, thus permitting the legs of the safety bracket **20.6**, loaded in the event of rollover of a convertible, roadster or sport-utility vehicle, to project therethrough and clamp or jam the first shoulder belt portion **1.1**.

Upon plug-in connection of the latch plate **2** with the buckle assembly **4, 4a, 4b** the belt end ER of belt portion **1.1** is connected to the coupling fitting **1.2a, 1.2b** (**Figs. 121a, 121b**), whereto a number of energy absorbers is attached to absorb energy. In a cost-saving embodiment without the latch plate **2** and buckle assembly, the belt end ER of belt portion **1.1** is directly connected to the coupling fitting **1.2a** or **1.2b** (**Fig. 186**) to receive energy absorbers, the retaining elements of which are fastened to the seat backrest frame **3.4d**. In order to absorb great energy and damp strong vibration ~~in the event during in-flight turbulence-related vibrations of an aeroplane~~ or in the accident of a fast speeding car or high-speed train, the belt retractor **13**, coupling fitting **1.2b** of which is connected to energy absorbers, is moveable attached to the oblong holes of a stiff plate **13.3**, fastened to the seat-backrest frame ~~in-at~~ the side SR so that the other belt end EL can be exploited to receive additional energy absorbers. In excess of threshold value the belt retractor pulls the clamping elements along the respective retaining elements to absorb energy and damp vibration.

In the 1st ~~and 2nd~~ to 3rd embodiment (**Figs. 12, 211a to 11c**) the buckle assembly **4a, 4b, 4c** is form- and/or force-locking connected to the seat-backrest-frame of the seat.

For the convenience of the passenger when egressing from the vehicle and in cases of emergency the following embodiments of detachment are proposed:

To disconnect the latch plates 2, 11 and/or 25 from the buckle assemblies 4, 14, 14a, 15, 15a (Fig. 1) and pairs of supplement upper buckle assemblies 18 / 19, 18a / 19a, 18b / 19b, 18.1 / 19.1 to 18.3 / 19.3, 19, 19a, 19b, 19.1 to 19.3 (Fig. 2315) of the seat arrangement, particularly for children, as well as from the anti-submarining buckle assemblies 7, 8, 8a to 8d (Figs. 1, 14), the master release button 84, when depressed, activates the release cables 4.2 and/or electrical release-motors 4.2b, which pull the release button 84a and/or 84b of the buckle assemblies (Figs. 112a, to 112bc, 21).

When depressing the master release button 84 the drive apparatus of the belt-feeding device 20, 20a, ~~to 20d~~ returns the first shoulder belt portion 1.1 from the operating-operative position to the resting position.

~~According to the traffic or flight law during the travel or turbulence-related flight passengers must remain belted. The need for a belted mother becomes apparent, when she must take care of her frightened children seating on the rear seat. The separately operated release button 84a, 84d, when depressed, detaches only the latch plates 11, 25 of the lap belt portion from the assemblies 7, 8, 8a, 8d (Figs. 1, 23) to annul the protection from submarining.~~

~~In the 1st embodiment (Figs. 19 to 21) the height and width adjusting mechanism 27 comprises a frame 29, buckle assembly 18.3, 19.3, a pair of tubes 27.4, members 27.5 to 27.9 and a pair of tubes 27.1 having a plurality of locking slots, in form and force-locking connection with an angle fitting 26a. The frame 29 consists of a pair of outer tubes 27.3, a pair of tubes 27.2 and a connecting member of all tubes. The locking handle 27.5 is form and force-locking connected to the slots of the inner tubes 27.4.~~

~~These inner tubes 27.4, inserted into the outer tubes 27.3, are pre-loaded by the springs 27.6. Each spring 27.6 on a sleeve 27.7, secured by pin 27.8, protruding through the holes of the inner tube 27.4, presses against the spring rest 27.9 of the outer tube 27.3.~~

~~The locking handle 27.5 is in engagement with a pair of locking slots of tubes 27.1. The locking handle 27.5, when pulled out from both slots, is detached therefrom. The height of mechanism 27 and buckle assembly can be adjusted~~

~~The outer tube 27.3 is provided with a plurality of locking slots q, r, s etc., drawn with dotted lines in Figs. 20, 22.~~

After the pawl **18.10**, pre-loaded by the spring **18.5**, is detached from the locking slot **r** by its movement in the direction of arrow (**Fig. 21**), the housing **18.12**, form-locking connected to the buckle assembly **4c**, can be moved along both outer tubes **27.3**.

Belt-detachable U-shaped latch plates **25** offer the passengers a feature to adapt their body proportions to the appropriate attachment points pair of supplement upper buckle assemblies into which the latch plates **25** are inserted (**Figs. 19-15, 23-17**). Any belt portion, such as **1.1, 1.2**, is loosely guided thereby, secured by a quick-release pin **25.1** thereof and detached therefrom by pulling the quick-release pin. To adapt a small body proportion of, say, a child, far lower than the upper buckle assembly 4 suited for adults, at least one pair of belt-  
detachable latch plates 25 are plug-in connected to one of the pairs of supplemental upper  
buckle assemblies 18 / 19, 18a / 19a, 18b / 19b, 18.1 / 19.1 to 18.3 / 19.3, arranged to the  
seat backrest at the first and second seat-side (Figs. 1 and 15). For safety reasons and easy  
access the belt-detachable latch plates 25, when not being used, are stored and secured in a  
storage box 25.5 of the seat (Fig. 15).

~~For juxtaposed seats in vehicles, buses, trains and aeroplanes it is recommended to use a single locking handle 27.5 to operate the 2nd embodiment of the height and width adjusting mechanism 27a of each seat 3c having, for example, three pairs of openings 18.1 / 19.1 to 18.3 / 19.3 to receive a pair of latch plates (Figs. 22, 23).~~

~~The frame 29a consists of two pairs of outer tubes 27.3, two pairs of tubes 27.2, a pair of connecting members of all tubes and members 18.3, 19.3, 27.6 to 27.9a, 27.11, attached to the outer tubes 27.3.~~

~~The locking handle 27.5 is form and force locking connected to slots of the inner tubes 27.4 by the pins 27.12. After inserting these inner tubes into the outer tubes 27.3 the locking plate 27.10 is form and force locking connected to the slots of the inner tubes and to the pins 27.12.~~

~~After securing the spring rest 27.9a by the retaining rings 27.11, both sleeves 27.7a by the pins 27.8, protruding through the holes of inner tubes 27.4 and oblong holes of outer tubes 27.3, the inner tubes with locking handle 27.5 are pre-loaded by springs 27.6. The locking handle 27.5, when pulled out from both slots, is detached therefrom. The height of height and width adjusting mechanism 27a can be adjusted.~~

Although the present invention has been described and illustrated in detail, it is clearly understood that the terminology used is intended to describe rather than limit. Many more

objects, embodiments, features and variations of the present invention are possible in light of the above-mentioned teachings. Therefore, within the spirit and scope of the appended claims, the present invention may be practised otherwise than as specifically described and illustrated.

What is claimed:

Claims 2 to 6, 11 to 13, 16, 19, 23, 27 to 30 and 39 to 41 (cancelled)

Claim 1. (currently amended) A multi-point seat belt ~~tfor increaseing~~ survival chance ~~for of~~ a passenger of a transport system in the event of an accident of a transport system or during or in-flight turbulence-related vibrations of an aeroplane, comprising

a first and second shoulder belt portion, a lap belt portion and an extending belt portions (1.1 to 1.4) and ~~two a first and second~~ belt ends (ELR) and (ERL), where

the extending belt portion (1.4), loosely guided by a shoulder-belt-portion deflector (5, 5b,

12) and ~~having having one the second~~ belt end (EL) ~~of which with the extending belt~~

portion (1.4), loosely guided by a ~~D-ring~~ shoulder belt portion deflector (5, 5b, 12) and

is equipped with a belt retractor (13), having a clamping device, ~~is arranged to and~~

attached to a stiff fourth vehicle body transport-system member, generally representing a

body floor of the transport system adjacent to a second seat-side or a seat-backrest

frame at the second seat-side or a post section of a motor vehicle adjacent to the second

seat-side or a floor (6) thereof;

the first shoulder belt portion (1.1), an end portion of which having the first belt end (ER)

and is arranged to attached to a stiff third transport-system member, generally

representing the floor of the transport system adjacent to a first seat-side or the seat-

backrest frame at the first seat-side;

a main buckle assembly (9.1), having a master release button (84), ~~adjacent to one side of the~~

seat frame (3.3, 3.3a to 3.3d) and arranged to attached to the floor (6) a stiff first

transport-system member, generally representing the floor of the transport system adjacent

to the first seat-side or a seat-cushion frame at the first seat-side or a mid-tunnel of the

motor vehicle adjacent to the first seat-side;

at least ~~two one~~ latch plates (2, 2a, 9, 11, 25);

a lower belt deflector (17) ~~which, deflecting and loosely guiding the lap belt portion (1.3) or~~

the first shoulder belt portion (1.1) and adjacent to the other side of the seat frame and

arranged to attached to the floor (6) a stiff second transport-system member, generally

representing the floor (6) of the transport system adjacent to the second seat-side or the

seat-cushion frame at the second seat-side or the post section adjacent to the second seat-

side or a side rail of the motor vehicle adjacent to the second seat-side, deflects and loosely guides the first and lap belt portion (1.1, 1.3) and the first shoulder belt portion (1.1); and at least one upper buckle assembly (4, 4b, 4c, 4e, 14, 14a, 18, 18a, 18b, 18.1 to 18.3) arranged to a side (SR) of a seat backrest; a belt-feeding device, provided with an operating arm (20.2), to a first end of which a belt ring (20.8) is rigidly attached to receive and loosely guide the first shoulder belt portion and a second end is connected to a guide tube (20.1), pivotally attached to a bearing casing (20.10) of the seat-backrest frame;

whereby

a lower body-part of his a body (96) of the passenger and an upper body-part (95) are restrained by the lap-belt portion (1.3) and the second shoulder belt portions (1.3, 1.2) when the main latch plate (9), moveable along the lap- and-or second shoulder belt portion, is plug-in connected to the main buckle assembly (9.1); and the upper body-part is restrained by the first and second shoulder belt portions, both (1.1, 1.2) extending crosswise in an X-shape when the shoulder latch plate (2), fastened to the other belt end (ER) of the first shoulder belt portion (1.1), is plug-in connected to the upper buckle assembly upon a rotatory movement of the operating arm with the first shoulder belt portion from a resting position at the second seat-side to an operative position at the first seat-side.

Claim 142. (currently amended) The multi-point seat belt according to claim 51, further comprising at least one drive apparatus, which, provided for at the belt-feeding device (20a, 20b) consisting of, when activated, rotates the operating arm with the first shoulder belt portion from the resting position to the operative position or vice-versa.

a belt housing (20.4a) equipped with the shoulder latch plate (2) of the first shoulder belt portion (1.1);

an operating arm (20.2a), to one end of which is connected the belt housing and the other end is connected to a guide tube (20.1) pivotally attached in a supporting tube (3.61) of a head rest (3.6a); and

at least one drive apparatus to rotate the operating arm with the belt housing;

whereby the shoulder latch plate (2) is inserted into and connected to the upper buckle assembly (4, 14, 18) and the first shoulder belt portion is moved from the resting position to the operating position by rotatory movement of the operating arm when the drive apparatus is activated.

Claim ~~73~~. (currently amended) The multi-point seat belt according to claim ~~52~~, wherein the master release button (84) ~~is provided with release cables (4.2) connecting to release buttons of the buckle assemblies where the master release button, when depressed, releases all the~~ main latch plates from the respective buckle assemblies and returns the belt-feeding device to the resting position.

Claim ~~184~~. (currently amended) The multi-point seat belt according to claim ~~143~~, wherein the master release button (84) is provided with ~~release wires connected to electrical release-motors (4.2b) of release buttons of the buckle assemblies and a release wire connecting to~~ the drive apparatus where the master release button, when depressed, releases ~~all the~~ main latch plates from the ~~respective-main~~ buckle assemblies and returns the belt-feeding device to the resting position.

Claim ~~205~~. (currently amended) The multi-point seat belt according to claim ~~21~~, wherein the multi-point seat belt (1, 1a to 1d) consists of

a three-point seat belt (1e); and

an ~~additional~~ upper first shoulder belt (1.12),

~~to the a first belt end of which is provided with a transition buckle assembly (4e), having a~~ transition release button (84c), in a home position is located on a seat-backrest aperture of the seat backrest at the first seat-side, attached and

~~the other a second belt end is arranged in attached to the side (SR) of the seat-backrest~~ frame at the first seat-side; and

where

a transition latch plate (2) ~~is, arranged to the a first belt end of a lower first shoulder belt~~ portion (1.11) of the three-point seat belt (1e); and

whereby

in a coupling position the passenger is restrained by plug-in connection of the main latch-plate (9) the transition latch plate (2) is plug-in connected with to the main buckle assembly (9.1) and of the transition latch plate (2) with transition buckle assembly (4e), pulled out from the seat-backrest aperture, therethrough a transition portion of the upper first shoulder belt is projected, where the lower first shoulder belt portion (1.11) projects through the lower belt deflector (17) at a sufficient length (l<sub>1</sub>) needed for the belt retractor to retract the first shoulder belt portion of the restrained passenger, defined by the lower

first shoulder belt portion and the transition portion~~the additional shoulder belt~~, in a real-world ~~the~~ accident.

Claim ~~216~~. (currently amended) The multi-point seat belt according to claim ~~205~~, wherein the ~~other second~~ end of the ~~additional upper first~~ shoulder belt (1.12) is provided with a second belt retractor (13a), which, ~~arranged in~~ attached to the side (SR) of the seat-backrest frame (3.2) at the first seat-side, has a spring force, which is less than that of the belt retractor (13),

whereby

in the coupling position the belt retractor pulls the upper first shoulder belt out from the second belt retractor through the seat-backrest aperture or in the home position the transition buckle assembly (4e), released by depressing the transition release button, is pulled by the second belt retractor until being located on the seat-backrest aperture.

Claim 7. (new) The multi-point seat belt according to claim 5, wherein the transition buckle assembly is provided with an electrical release-motor (4.2b), which, when receiving an electrical signal from the main buckle assembly resulting from depressing the main release button releasing the main latch plate, pulls the transition release button to release the transition latch plate.

Claim 8. (currently amended) The multi-point seat belt according to claim ~~71~~, wherein the lower belt deflector (17) comprises a housing, having an attachment hole, and a pin (17.1), attached in the housing to form an aperture ~~which loosely guiding the belt portion~~ retains the shoulder latch plate (2) when released.

Claim 9. (original) The multi-point seat belt according to claim 8, wherein the pin (17.1) is surrounded by a sleeve (17.2).

Claim 10. (original) The multi-point seat belt according to claim 9, wherein the lower belt deflector (17) is made of one piece.

Claim ~~311~~. (currently amended) The multi-point seat belt according to claim ~~43~~, further comprising a ~~belt feeding device (20), belt feeding members of which in the resting or operating position are countersunk in the seat backrest, where the belt feeding device consists of~~



an operating arm ~~(20.2)~~, to one end of which a belt ring ~~(20.8)~~, having a key, is rigidly attached to the belt ring of the operating arm; and to house and loosely guide the first shoulder belt portion ~~(1.1)~~ and to the other end a guide tube ~~(20.1)~~ is rigidly attached; the guide tube ~~(20.1)~~, which, pivotally attached to a bearing casing ~~(20.10)~~ of a, is rotated from the resting position to the operating position by at least one drive apparatus, when activated; and

a belt-feeding plate ~~(20.9, 20.9a)~~, a contact portion of which, moveable in an opening of the seat backrest at the first seat-side and guided thereby located on a top edge of the seat backrest at the side (SR) thereof, has a receptacle through which the key projects in a contact position and the operating position;

whereby the drive apparatus, being activated,

moves up over a head rest the contact portion of the belt-feeding plate out of the opening and the guide tube with the operating arm and with the first shoulder belt portion;

rotates the operating arm and the first shoulder belt portion over the head rest, a head of the passenger and in front of the his upper part of his body until the key engages with the receptacle in a the contact position and

countersinks the contact portion belt-feeding plate and the guide tube with the operating arm in the seat backrest until reaching the operating position in which the first shoulder belt portion extends across over the his upper body part of the body and, finally, the drive apparatus is switched off;

where in the operative position or in the resting position the contact portion of the belt-feeding plate and the guide tube with the operating arm are countersunk in the seat backrest.

Claim ~~17~~12. (currently amended) The multi-point seat belt according to claim ~~14~~11, wherein the operating arm ~~(20.2a)~~ is a radial-adjustable tube ~~(20.3)~~ is attached between the belt ring and the guide tube, where the first shoulder belt portion is moved from the resting position to the operating position by a radial-adjusting movement of the radial-adjustable tube when the drive apparatus is activated.

Claim ~~37~~13. (currently amended) The multi-point seat belt according to claim ~~31~~11, wherein the drive apparatus is operable to return the first shoulder belt portion ~~(1.1)~~ from the operating position to the resting position, when a dwell time, predetermined for an engagement of the key with the receptacle, is exceeded.

Claim ~~15~~14. (currently amended) The multi-point seat belt according to claim ~~14~~11, wherein the drive apparatus returns the first shoulder belt portion (1.1) from the operatingve position to the resting position, when a dwell time, predetermined for insertiong of the ~~shoulder-main~~ latch plate (~~2~~) into the main upper-buckle assembly (~~4, 4a to 4c, 14, 14a, 18~~), is exceeded.

5 Claim ~~33~~15. (currently amended) The multi-point seat belt according to claim ~~31~~11, wherein the drive apparatus, activated in response to activating a switch, attached in the main buckle assembly (9.1), upon contact with a cam of the main latch plate (9), when inserted therein, is switched off when the operatingg position is reached.

10 Claim ~~34~~16. (currently amended) The multi-point seat belt according to claim ~~31~~11, wherein the drive apparatus, activated in response to starting an engine of the transport system, is switched off when the operatingg position is reached.

Claim ~~35~~17. (currently amended) The multi-point seat belt according to claim ~~31~~11, wherein the drive apparatus, activated in response to closing a vehicle door of the transport system, is switched off when the operativng position is reached.

15 Claim ~~32~~18. (currently amended) The multi-point seat belt according to claim ~~31~~11, wherein the drive apparatus, activated in response to actuating a switch, is switched off when the operatingg position is reached.

20 Claim ~~36~~19. (currently amended) The multi-point seat belt according to claim ~~31~~11, wherein the drive apparatus is activated when the passenger takes hisa seat, whereto a ~~pressure~~-sensor is built, where the drive apparatus is switched off when the operativng position is reached.

Claim ~~38~~20. (currently amended) The multi-point seat belt according to claim ~~31~~11, wherein the drive apparatus, activated in response to depressing x-times the master release button (84), is switched off when the operativng position is reached.

25 Claim ~~43~~21. (currently amended) The multi-point seat belt according to claim ~~11~~11, wherein the supplement latch plate is a belt-detachable latch plate (25), which has a quick-release pin (25.1) and a U-shaped portion to house the belt portion of the seat belt which is secured therein by the quick-release pin and detached therefrom by pulling it.

Claim ~~22~~. (new) The multi-point seat belt according to claim 21, wherein the seat backrest at the first and second seat-side is provided with pairs of supplement upper buckle assemblies (18 / 19, 18a / 19a, 18b / 19b, 18.1 / 19.1 to 18.3 / 19.3).

one of which is adapted to a small body proportion of the passenger, lower than the upper buckle assembly, and, finally, the belt-detachable latch plates, housing both shoulder belt portions, are plug-in connected to that pair.

Claim 23. (new) The multi-point seat belt according to claim 22, wherein the belt-detachable latch plates, when not being used, are stored and secured in a storage box (25.5) of the seat.

Claim ~~26~~~~24~~. (currently amended) The multi-point seat belt according to claim ~~24~~~~22~~, wherein the belt end (~~ER~~) of the first shoulder belt portion (~~1.1~~) upper buckle assembly is provided with a coupling fitting (1.2a, 1.2b) to receive energy absorbers.

Claim ~~7~~~~25~~. (currently amended) The multi-point seat belt according to claim ~~5~~~~22~~, wherein the master release button (84) is provided with release cables (4.2), connecting to release buttons of all the supplement upper buckle assemblies, and with a release wire, connecting to the drive apparatus, where the master release button, when depressed, releases all the latch plates from the respective buckle assemblies and returns the belt-feeding device to the resting position.

Claim ~~42~~~~26~~. (currently amended) The multi-point seat belt according to claim ~~40~~~~25~~, wherein a belt-catching member (20.7, 20.7a), is attached to the seat backrest, ~~to~~ intercepts and holds at least one shoulder belt portion when being in the resting position.

Claim ~~22~~~~27~~. (currently amended) The multi-point seat belt according to claim ~~24~~, further comprising a belt-feeding device (~~20, 20c, 20d~~) consisting of

a pair of rollover tubes (20.2b), inserted into a pair of angle fittings (26a) of the seat-backrest frame (3.4d);

a belt housing (20.4d), ~~in~~ which, ~~movable~~ moveable along the pair of rollover tubes and guided thereby, receives and loosely guides the first shoulder belt portion ~~is located~~; and an additional drive apparatus, fastened to the belt housing and moveable ~~movable~~ along a threaded spindle (20.1a), fastened to the pair of angle fittings (26a), ~~to translatory move the belt housing;~~

whereby the first shoulder belt portion is moved from the resting position to the operating position by a translatory movement of the belt housing and the rotatory movement of the operating arm when the both drive apparatus isare activated.

Claim ~~24~~28. (currently amended) The multi-point seat belt according to claim ~~23~~27, wherein the translatory movement of the belt housing and the rotatory movement of the operating arm are synchronised.

Claim ~~25~~29. (currently amended) The multi-point seat belt to protect the passenger in a rollover-accident according to claim ~~24~~28, wherein the belt-feeding device (**20c, 20d**) serves as a protective-rollover device having the pair of rollover tubes (**20.2b**), along which the belt housing (**20.4d**), having holes to receive a pair of legs of a safety bracket (**20.6**), is moved in the operating position, where

~~the holes of the belt housing and holes of one of the rollover tubes (20.2b) and the holes of the belt housing~~ are aligned with each other and

in excess of a threshold value in the rollover-accident the pair of legs of the safety bracket protrudes through all the holes, thus blocking the translatory movement of the belt housing and clamping the first shoulder belt portion.

Claim ~~1~~30. (currently amended) A multi-point seat belt ~~for increaseing survival chance for of a passenger of a transport system in the event of an accident of a transport system or duringor in-flight turbulence-related vibrations of an aeroplane,~~ comprising

a first and second shoulder belt portion, a lap belt portion and an extending belt portions (1.1 to 1.4) and two a first and second belt ends (ELR) and (ERL), where

the extending belt portion (1.4), loosely guided by a shoulder-belt-portion deflector (5, 5b, 12) and having having one the second belt end (EL) of which with the extending belt portion (1.4), loosely guided by a D-ringshoulder belt-portion deflector (5, 5b, 12) and is equipped with a belt retractor (13), having a clamping device, is arranged to and attached to a stiff fourth vehicle bodytransport-system member, generally representing a body floor of the transport system adjacent to a second seat-side or a seat-backrest frame (3.4d) at the second seat-side or a post section of a motor vehicle adjacent to the second seat-side or a floor (6) thereof; and;

the first shoulder belt portion (1.1), has an end portion of which having the first belt end (ER) is arranged to and is attached to a stiff third transport-system member, generally

representing the floor of the transport system adjacent to a first seat-side or the seat-backrest frame at the first seat-side;

a main buckle assembly (9.1), having a master release button (84), ~~adjacent to one side of the seat frame (3.3, 3.3a to 3.3d) and arranged to~~ attached to the floor (6) a stiff first transport-system member, generally representing the floor of the transport system adjacent to the first seat-side or a seat-cushion frame at the first seat-side or a mid-tunnel of the motor vehicle adjacent to the first seat-side;

at least ~~two~~ one latch plates (2, 2a, 9, 11, 25);

a lower belt deflector (17) ~~which, deflecting and loosely guiding the lap belt portion (1.3) or the first shoulder belt portion (1.1) and adjacent to the other side of the seat frame and arranged to~~ attached to the floor (6) a stiff second transport-system member, generally representing the floor (6) of the transport system adjacent to the second seat-side or the seat-cushion frame at the second seat-side or the post section adjacent to the second seat-side or a side rail of the motor vehicle adjacent to the second seat-side, deflects and loosely guides the first and lap belt portion (1.1, 1.3) and the first shoulder belt portion (1.1); and

at least one upper buckle assembly (4, 4b, 4c, 4e, 14, 14a, 18, 18a, 18b, 18.1 to 18.3) ~~arranged to a side (SR) of a seat backrest;~~ a belt-feeding device, consisting of a pair of rollover tubes (20.2b), inserted into a pair of angle fittings (26a) of the seat-backrest frame (3.4d);

a belt housing (20.4d), which, moveable along the pair of rollover tubes from a resting position at the second seat-side to an operative position at the first seat-side and guided thereby, receives and loosely guides the first shoulder belt portion; and a drive apparatus, fastened to the belt housing and moveable along a threaded spindle (20.1a), fastened to the pair of angle fittings (26a);

whereby

a lower ~~body-part of his~~ a body (96) of the passenger and an upper ~~body-part~~ (95) are restrained by the lap ~~belt portion (1.3)~~ and the second shoulder belt portions (1.3, 1.2) when the main latch plate (9), moveable along the lap- and-or second shoulder belt portion, is plug-in connected to the main buckle assembly (9.1); and

the upper ~~body-part~~ is restrained by the first and second shoulder belt portions, both (1.1, 1.2) extending crosswise in an X-shape ~~when the shoulder latch plate (2), fastened to the other belt end (ER) of the first shoulder belt portion (1.1), is plug-in connected to the~~

upper buckle assembly upon a translatory movement of the belt housing with the first shoulder belt portion from the resting position to the operative position in response to the drive apparatus being activated.